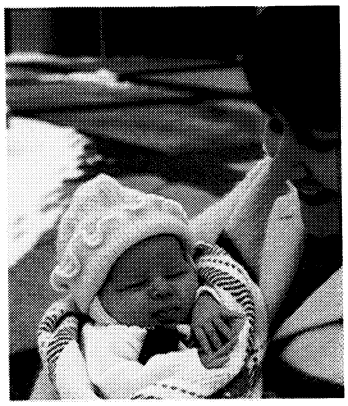


At left, Dr. Bonny Specker, an epidemiologist at the University of Cincinnati Medical Center, holds an infant who is wearing a sunlight-measuring device known as a solar dosimeter. A spinoff from NASA solar cell technology developed to provide spacecraft power, the solar dosimeter played a part in an important study conducted last year by Dr. Specker and her Medical Center associates, bioengineer Neil Edwards, research assistant Sean Lyon and director of neonatology Dr. Reginald Tsang.

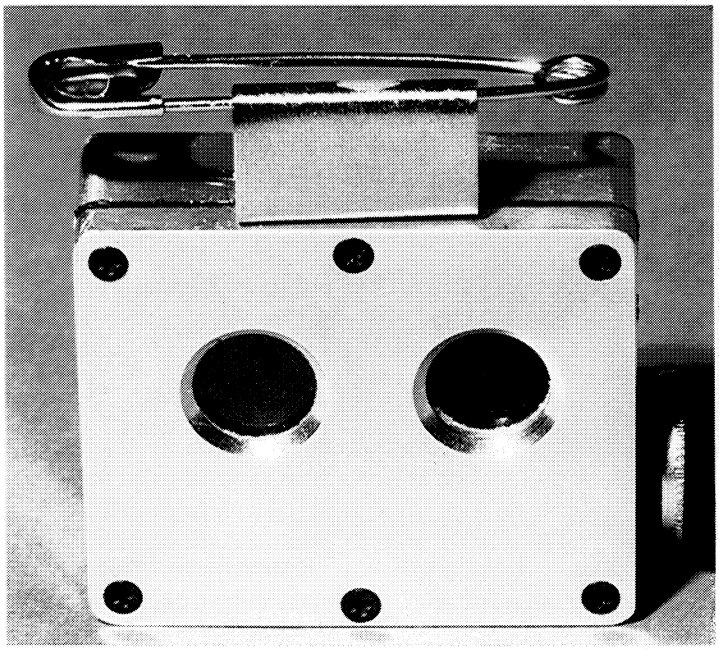
The group investigated the effect of sunlight exposure on maintaining vitamin D status in infants. Vitamin D is derived from dietary sources or produced by the skin after stimulation by ultraviolet light. The effect of sunshine on vitamin D is particularly important to exclusively breast-fed infants who are not receiving supplements, because the vitamin D content of breast milk is low.

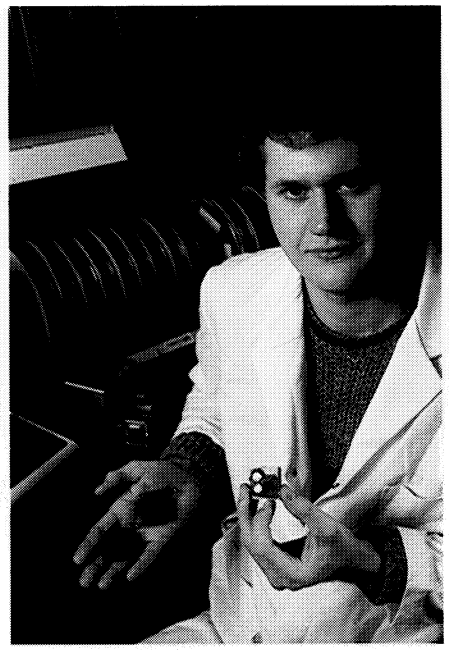
In order to investigate the relationship between sunshine exposure and vitamin D, it was necessary to develop a method of quantifying sunshine exposure in infants. This was accomplished in part by a specifically designed "sunshine diary," in which volunteer mothers recorded—each day for a week—how many minutes the infant was outdoors and what type of clothing was worn.

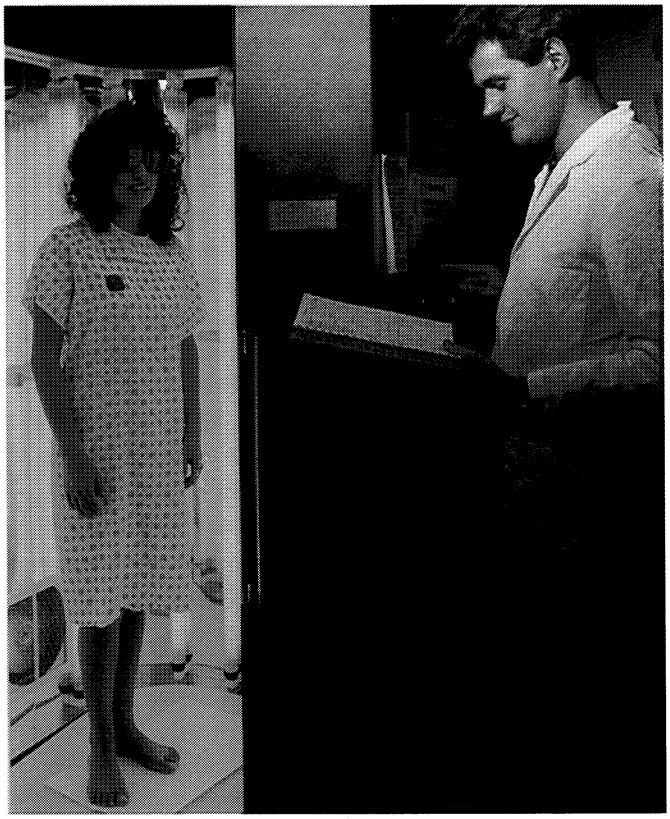
Looking for a way to double check the diary, engineer Neil Edwards read an article in the NASA publication *Tech Briefs* (see page 127) that described the solar dosimeter, a miniature integrating light meter originally developed by Langley Research Center for measuring accumulated radiation in the ultraviolet and other regions of the spectrum.

Biomedical researchers at the University of Virginia, conducting long-term studies to clarify the role of sunlight in inducing skin cancer, expressed a need for a miniaturized solar dosimeter that could be worn by study participants throughout a day's activity and provide data on the amount of solar radiation to which the wearer was subjected. Langley adapted the technology to the simple, personal-use dosimeter shown at right center. The two circular "eyes" are silicon photovoltaic detectors that collect incident solar energy after passage through filters. The received energy is converted to electrical signals that are proportional to the amount of radiation absorbed. The electric charge is transmitted to E-cells that record the charge by plating silver ions onto an electrode; on completion of an activity period, the total radiation received by the wearer of the device can be determined by measuring the time required to replate the silver. The dosimeter was used in the University of Virginia study and later in another sunshine exposure study conducted by Virginia Polytechnic Institute and State University.

The University of Cincinnati's Edwards followed up on the *Tech Briefs* article by obtaining from Langley Research Center a Technical Support Package that provided details of the solar dosimeter's construction and operation and by conferring with Langley officials. Satisfied that the device was the answer to its need, the Medical Center sought and received a license from NASA, and Edwards' engineering group fabricated about 70 units of the dosimeter for the vitamin D investigation. The Cincinnati team employed the basic technology







but modified the dosimeter, making it tamper-proof by sealing it, making it more durable and making it smaller for easy wear by infants. At upper right, medical student Bill Brazerol, who assisted the Cincinnati investigators in the study, displays the Medical Center's version of the dosimeter. Right below, an adult wearer of the dosimeter is given a dosage of ultraviolet in a light chamber, part of an additional Medical Center study relating vitamin D synthesis to skin pigmentation.

In the Cincinnati investigation, readings from the solar dosimeter correlated well with the sunshine diary data recorded by participating mothers. The study provided considerable valuable information on the sunshine exposure/vitamin D relationship, including the fact that vitamin D concentrations in the blood of infants correlated directly with the degree of sunshine exposure, and that infants were able to maintain vitamin D concentrations within normal ranges with sunshine exposure of only 30 minutes a week when wearing diapers or two hours a week fully clothed. ▲